Watershed Management

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Lecture No. # 04

Sustainable Watershed Management

Namaste and welcome to the video course on watershed management. The last 3 lectures in module 1, we have seen the basic concepts of watershed management. In today's lecture we will start the module 2; module 2 is on sustainable watershed approach and watershed management practices. So, in today's lecture, topic is sustainable watershed management.

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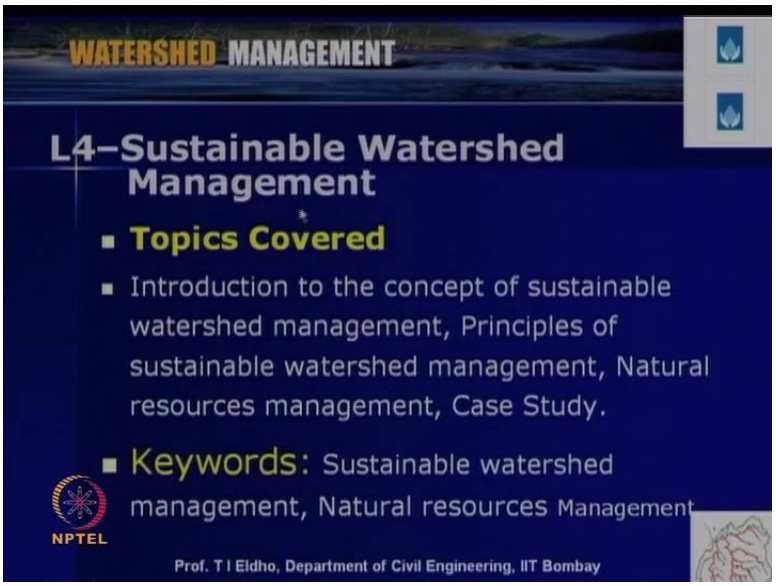

So, in today's lecture, the topics covered include introduction to the concept of sustainable watershed management, principles of sustainable watershed management, natural resource management and finally, we will discuss a case study.

So, some of the important keywords in today's lecturing would sustainable watershed management, natural resource, resource management. So, we have seen the basics of watershed management and the concepts of watershed management.

So, as we have discussed earlier, in all the watershed management practices, we are looking for the, looking for the sustainable development and then, environment friendly development. So, always, the question of sustainable development and ensure in all kinds of developmental activities.

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So, now let us see, what is so called sustainable development? So, sustainable development, we can define it as meeting the needs and aspirations of present generation without compromising the ability of future generation to meets their needs.

So, within the (( )) of watershed management, so sustainable development means, so we are developing the resources like land, water and all other resources within the watershed. So, that, that way, so we want to meet the present needs, but of course, you should not overuse or we should not disturb the ecological or environmental balance, such that the future generation will suffer. So, that way we have to see, that whenever we are going for watershed management, the watershed management plan should be sustainable and we should go for sustainable development.

So, the aim of any sustainable development will be to integrate the economics, the science of development and ecology such a way, that we have an environmental friendly development, so that the science of environment is also, will be incorporated within the developmental plans.

So, sustainable development must deal with a threat of poverty, population growth and environmental degradation. So, as you can see that in a country like India, we have got a big problem of the, the population growth. So, we have to see, that when we take a, the watershed management as holistic plan, so we have to see that the, the, how we can look into the aspects of population growth. Then, how we can deal with the, the threat of poverty?

So, in many of the whole watershed, especially arid and semi-arid regions, we can see, that poverty or economical issues are a major problem and then, another issue is the environmental degradation. So, the sustainable growth is not possible or sustainable development is not possible without considering the environmental issues, then the poverty and then, all over socio-economical improvements.

So, then, in the sustainable development, it preserve and enlarge the physical human and environmental capital. So, we, if you consider the resources as a capital, then we are going for development plans for the watershed considered. So, in such a way, that the capital is a, the total capital, the total resource are made it in such a way, that we preserve and enlarge the various aspects of the resources with available within the watershed.

So, finally, the sustainable development, we are always looking in such a way, that the growth, what is happening within the watershed scale or within the, within the country or within the state. So, the growth should be in such a way, that it is woven around the people; so, it is not the people are around the growth. So, always, we should look into this aspect.

So, the sustainable development should be in such a way, that we have to go for development of growth for the people and it should be woven around the people, not just, just like we construct some structures or we do something and then, people should be around that growth. So, that is the fundamental principle of the sustainable development. So, now, you can see here, in any of the sustainable development issue.

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So, here, this is the sustainable development and then, various factors of, we have to deal with various factors and the various issues, so there can be like, social issues or social factors, then environmental issues, then political related issues and then of course, the economical issues. So, all those things will be interacting when we discuss about the sustainable development.

So, everything will be coming together and then, we have to look into the sustainable development in a, with a holistic view. So, in the sustainable development, we wish to achieve the sustainability for a, which is socially acceptable, economically and technically viable. Then, of course, as we discussed, it is always multi-disciplinary approach will be coming and then we have to develop the various social institution and then, we have to look for the stake holders involvement, so that we can achieve a holistic development.

And then, of course, as far as watershed management is concerned, capacity building, all those issues will be coming as far as a sustainable watershed development plans or sustainable watershed management is concerned.

So, to achieve all those things, we should have plans in such a way, that good science is there and smart planning is there, as far as the watershed management plans are concerned. So, these are some of the important issues, which we have to consider as far

as sustainable development is concerned. And now, before going to the sustainable watershed management, so let us see some of the issues related to sustainable development and water resources management.

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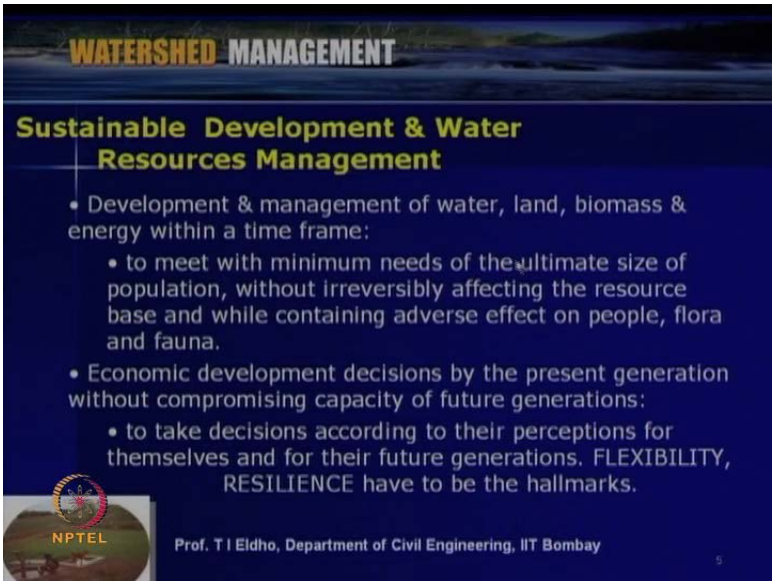

Development and management of water, say water, land, biomass and energy, so these things should happen within a time frame for the considered area to meet with minimum needs of the ultimate size of population, without irreversibly affecting the resource base and while containing adverse effect on people, flora and fauna.

So, as we have discussed in the last slide, so sustainable development within the perspective of water resource management is concerned, we have to see, that water is a resource, so we have to develop and manage the water. So, of course, water means, we have to consider land issues also, biomass issue also, such that we have to meet the minimum needs and say, the, the, the fruits of this development should reach all the section of the society and then not only for the present, but for the future generations also.

So, then, economic development decisions, like here when we consider watershed development plans, this decision by the present generation should not compromise the developmental activities of the future generation. So, that is the case of whatever we consider here, water resource development and management also. So, such that we have

taken decisions according to their perceptions for themselves and for their future generations.

So, in all these sustainable development and then management, the theme is, we should go for, there should be flexibility, the plan should be flexible, then resilience should be there. So, these are some of the important hallmarks as far as the sustainable development, say as far as either water resource development or land development and management is concerned, within the perspective of watershed management.

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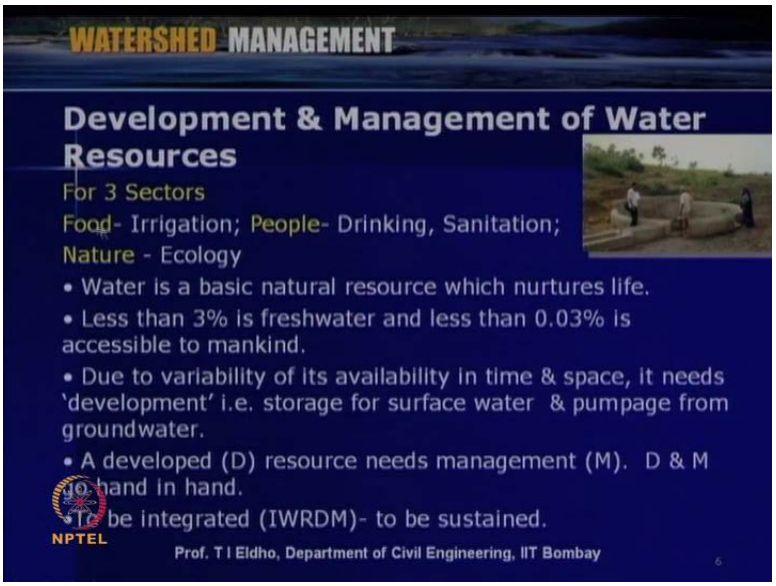

So, now say, if we consider the development and management of water resource is concerned, we, we, we have to look, to look to the developmental issues and management issue as far as 3 sectors are concerned, 1st one is, we should look to the food production. So, mainly, as within the perspective of water, we are looking for the availability of water for irrigation, since compared to the rain-fed agriculture, irrigation improves the production, say in many cases, more than 50 percent or even 100 percent extra production is possible. So, one important sector is food production, so that as far as water is concerned, we will be looking for the irrigation.

And then, 2nd sector is people. So, there, the, we will be looking for water for drinking purpose, sanitation purpose and then, also for any industrial activities, then creation purpose, etcetera. And then, another sector is so called nature. So, nature is means, the

ecological needs for the considered area, so we have to, we should have sufficient water for that purpose.

So, whenever we are looking for the water resource development and management is concerned, we are mainly looking to 3 sectors: one is food, then the people needs and then ecological or natural needs.

Then, as we discussed, water is a basic natural resource, which nurtures life. So, without water we cannot sustain, but even though so much of water is available, only less than 3 percent is fresh water what is available on the globe and then, out of this, even only less than 0.03 percent is accessible to mankind. So, these are some of the major issues as far as water source management is concerned.

So, due to this variability, variability of water available in time and space, so that means, say, water is not available at any location wherever we need or water is not available all the time whenever we need, say for example, India is concerned we have got this rainfall during the monsoon season, which starts from June to September or October. So, remaining say, 8 months or in 7 months we do not have the rainfall. So, that way time, say whenever it is available, according to that we have to deal and then, spatial variation. So, like as we have discussed in the last lecture, say in Rajasthan we have got a hardly, western Rajasthan is about 100 mm of rainfall, but in some locations there is 10,000 mm of rainfall. So, that way, by spatially also lot of variation is taking place.

So, hence, as far as water is concerned, this, due to all this issues it needs developments. That means, storage for surface water and then in ground water and then pumpage from the ground water. So, that means, say, we have to deal the, say for example, water as a resource we have to deal in a holistic way and then, we have to develop the resources like either surface water or ground water and then of course, when we develop the resources, then we need its management.

So, the development and management go hand in hand. So, whatever the resources we develop, we have to manage it properly. So, that is the basic concept behind the integrator water resource development and managements in, so that we have sustainability as far as water is concerned. And then, of course, within the prospective

watershed management also, and we have to achieve the variable, the various sustainable goals, which we set for the particular area.

So, this IWRDM or Integrator Water Resource Development and Management, is one of the important aspect, which is there in many of the public discussions like United Nations or UNESCO discussion, and now this has come to the forefront of the many of the governments, so that the, there is integrated development and management as far as water resource is concerned. So, this issue regarding integrated water resource development and management, we will be discussing later.

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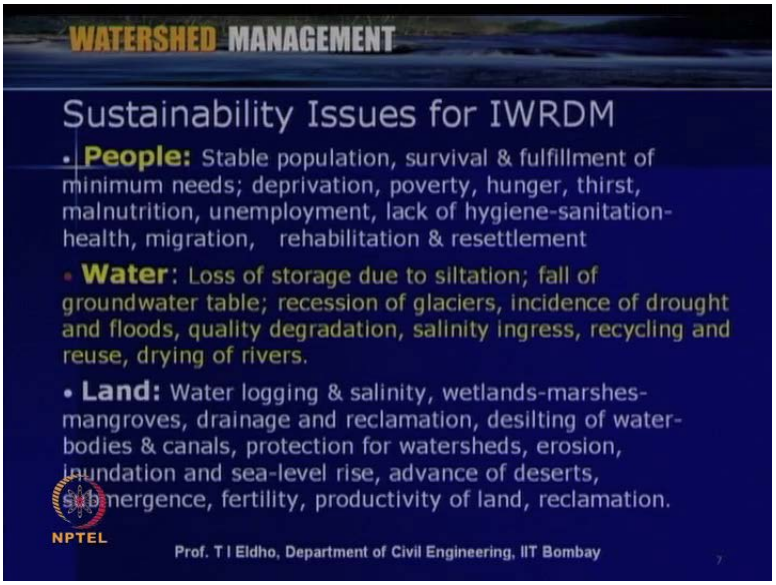

So, then, as far as the, now we are discussing the sustainability issues. So, as far as the integrated water resource development and management is concerned, we will have a brief look into the variable sustainability issues. So, say, the issues concerned to people, water and land we will be discussing here. So, as for as IWRDM is concerned, the various sustainability issues as far as people are concerned, say the water requirement for stable population. So, with the population is increasing, then water needs increases like that, then survival and fulfillment of minimum needs, then and deprivation, poverty, hunger, thirst, malnutrition, unemployment, lack of hygienic, hygiene, sanitation, health, migration, rehabilitation and resettlement. So, these are some of the issues, which we have to consider when we discuss the indicated water resource development and

management. And then, of course, sustainable watershed management issues are also considered.

So, even though some of these issues are not directly connected to the water resource development and management, but some of the issues are indirectly connected with respect to IWRDM, say for example, unemployment; employment, we can generate employment, if sufficient agriculture practice are there, so that sufficient water is available.

So, mainly, some of the issues, even though not directly connected with the IWRDM, but we can indirectly connect. Then, as far as water is concerned, the main issue is the quantity of water and quality of water. So, some of the sustainability issues are listed here, like loss of storage due to siltation, then fall of ground water table, then recession of glaciers, then incidence of drought and floods, then quality degradation as far as surface water, ground water is concerned, then salinity ingress, especially in coastal regions, then recycling and reuse of the waste water, then drying of rivers. So, these are some of the sustainability issues as far as water is concerned.

Then, some of the sustainability issues as far as land is concerned are listed here; it is like water logging and salinity. So, this also somewhat related to water and land. Then, wetlands, marshes, mangroves, drainage and reclamation, desilting of water bodies, then and cannels and protection for watersheds, erosion problems, inundation and a sea level rise, advancement of desserts, submergence, soil fertility, then productivity of land reclamation, etcetera. So, these are some of the sustainability issues as far as land is concerned.

So, when we looking to the holistic issue of integrated water resource development and management or say watershed management, we have to see, that what is happening to various resources like a, like the sustainability issues as we discussed about land or water or people or flora and fauna within the watershed. So, these are some of the important issues, which we have to consider in this type of studies.

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So, then finally, the sustainability issues as far as the product and facilities and biomass are concerned, some of the issues are listed here. So, the product coming out of a watershed or an area, like a level of food production, then a balance to composition, then quantity and quality, timeliness of supply as far as various agricultural products are concerned, then energy generated, then healthy environment. So, these are some of the sustainability issues as far as the product coming from a watershed or particular area is concerned.

Then, some of the facilities within an area, like dams, canals, pumps, turbines, embankments, then their repairs and modernizations, replacements, enlargement, safety, longevity, desiltation, serviceability, upkeep, special repairs. So, as it, like this there are so, so many sustainability issues as far as facilities are concerned. Then, the biomass within a watershed or within a area is concerned, say, like conservation of biodiversity, then gene banks, tissue culture, energy plantations, irrigated forestry, biosphere, then conservation zones like glass houses for the various agriculture development, etcetera. So, these are some of the important issues, which we have to consider when we discuss sustainability development or sustainability as far as various resources, like land, water, then biomass, etcetera is concerned.

So, for each of these sustainability issues we can develop, say performance indicators, so that the indicators shows, how the system is behaving or how the system is the

sustainable as far as the, the issues are concerned. So, in literature, you can see that some performance indicators are given as far as the sustainability issues are concerned or these particular points are concerned. So, accordingly, when we consider a watershed or a particular area, we can define that or we can, say, describe that, that particular issue is or particular aspect is sustainable for the particular area or particular watershed is concerned.

So, now, within this prospective, now we will go into details of the sustainable watershed management. So, as far as watershed management plans are concerned, what are sustainability, sustainability issues and then, how we can deal with these kinds of issues? So, these issues, within the prospective of watershed management, we will discuss here now.

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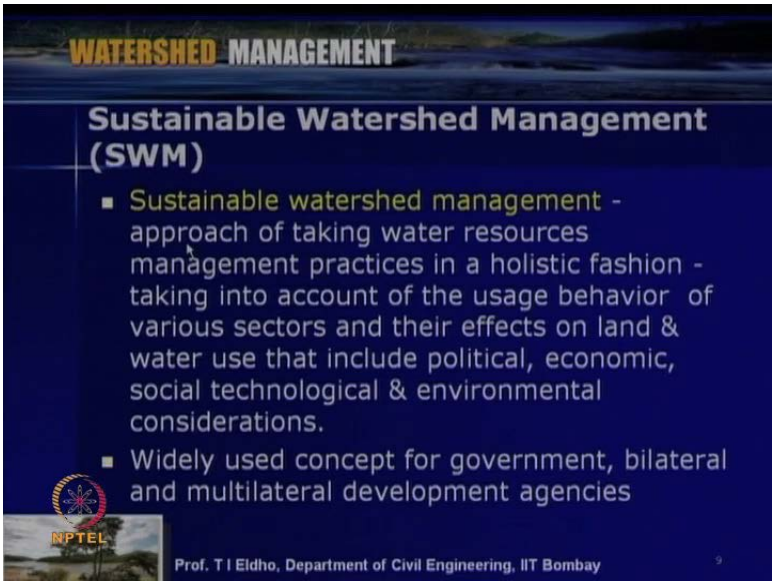

So, sustainable watershed management means, it is approach of taking water resources, management practices in a holistic fashion taking into account of the usage, behavior of various sectors and their effects on land and water use, that include political, economic, social, technological and environmental consideration. So, this is a broader definition as far as sustainable watershed management is concerned.

So, in a brief way, we can say, that sustainable watershed management means, say, the various resources within the watershed management, watershed is concerned and we are

looking to a holistic development, by considering the ecological aspects, by considering the environmental aspects, so that whatever the development personally taking place, that should not affect the development, what can happen in future. So, that is the concept behind the sustainable watershed management. So, this sustainable watershed management is widely used concept, say, as far as various government agencies, then bilateral multilateral development agencies, like World Bank, then United Nations or the IMF, etcetera.

So, most of the time, now you can, here the developmental issues, whether the development is sustainable or the watershed development is sustainable or watershed management plans are sustainable. So, now, we very commonly use this, we had a sustainable, whether the plans, which we consider is sustainable or not.

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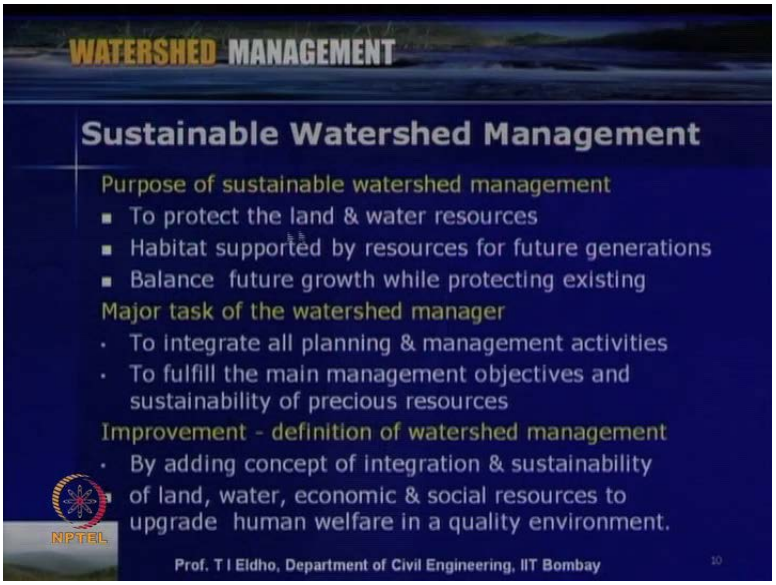

Now, when we consider the sustainable watershed management, the purpose of sustainable watershed management is to protect the land and water resources. So, as I mentioned, various resources within the watershed and then, the habitat within that watershed supported by resources for future generations, and then balance the future growth while protecting the existing. So, these are the some of the purposes as far as sustainable watershed management is concerned.

Then, a major task of the watershed manager, so when we look into watershed development plans, the, as far as watershed manager is concerned, so he or she has to integrate old planning and management activities, such that sustainability issues are resolved or looked into, then to fulfill the main management objectives and sustainability of precious resources. So, these are some of the major tasks as far as a watershed manager is concerned.

So, within this perspective, now we can redefine the watershed management. So, in such a way, that watershed management is, we can consider as by adding the concept of integration and sustainability of land, water, economic and social resources to upgrade human welfare in a quality environment.

So, within the prospective of the sustainability issues, which we have discussed so far and we can redefine the watershed management as the concept of integration of the various resources like land, water, within the perspective of economical, social aspects, so that the total quality of life or total environmental quality is improved. So, that is the way within the perspective of sustainability, we can redefine the watershed management.

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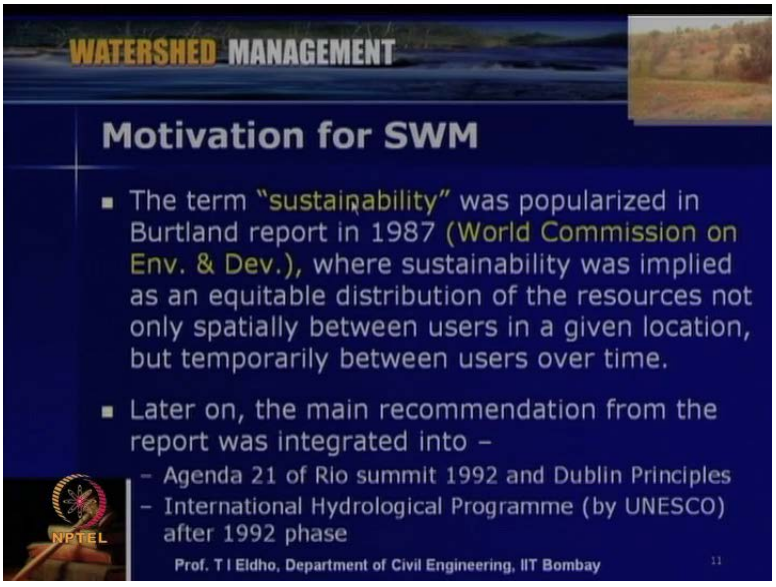

Let us look into the motivation for sustainable watershed management. So, the term sustainability was popularized in a report by Burtland in 1987, in a report for water world commission on environment and development.

So, here, as per Burtland, the sustainability was implied as an equitable distribution of the resources, not only spatially between the users in a given location, but temporarily between users over time. So, this was the definition given by Burtland in his report in 1987. So, later on, this sustainability and then sustainable issues were taken over in most of the various forums, like agenda 21 of Rio summit in 1992, then Dublin principles, then United Nations and then UNESCO, etcetera.

So, now, after this 1987 report, so many of the meetings or many of the welled forums, they, they, they were seriously looking to the issue of sustainability and then its related issues, and then of course, the watershed, within, within the perspective of watershed management.

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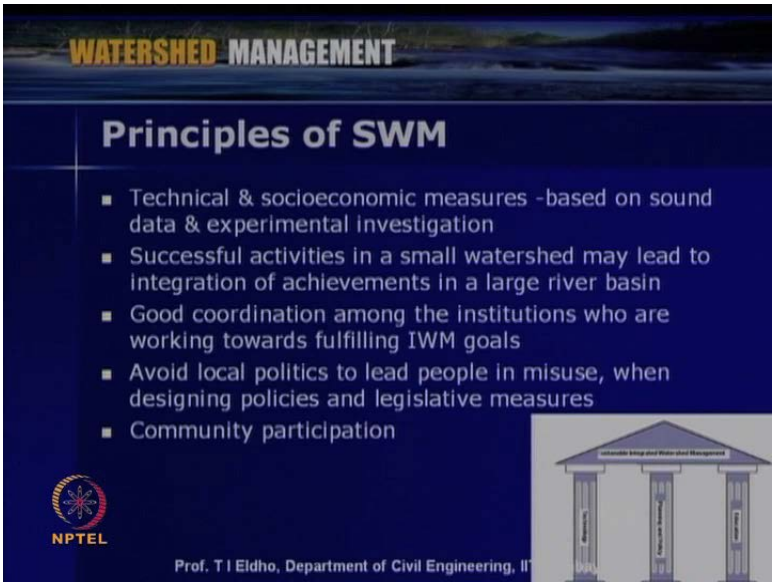

So, when we discuss the watershed management, what are the important principles of sustainable watershed management? So, some of the important principles are listed here.

So, technical and socio-economic measures based on sound data and experimental investigation. So, this is a, the 1st principle. Then, successful activities in a small watershed may lead to integration of achievements in a larger river basin. So, when we start the sustainable development, watershed management plans for a small watershed, so like that we can go for a larger river basin. Then, 3rd principle is good coordination among the institutions, which are involved and working towards fulfilling the integrated

watershed management goals. Then 4th one is, avoid local politics to lead people in misuse when designing policies and legislative measures. So, this is where the stake holder participation comes into picture. So, there is no politics, local politics cannot come into picture, if it is we are looking for holistic development and overall improvement for the system. So, like that another important principle as far as sustainable watershed management is the community participation, this issue also we have discussed earlier.

So, within the sustainable watershed management, we can say, represents the development plans in such a way, that the 1st pillar is technology, so the various, the developmental aspect with the help of technology. Then, we can look into the planning and a policy, that, that is another pillar of, as far as the sustainable watershed management is concerned; then, the overall education and overall, the development of the region. So, these are some of the important aspects of sustainable watershed management.

Now, let us look into what is important framework as far as the sustainable watershed management is concerned.

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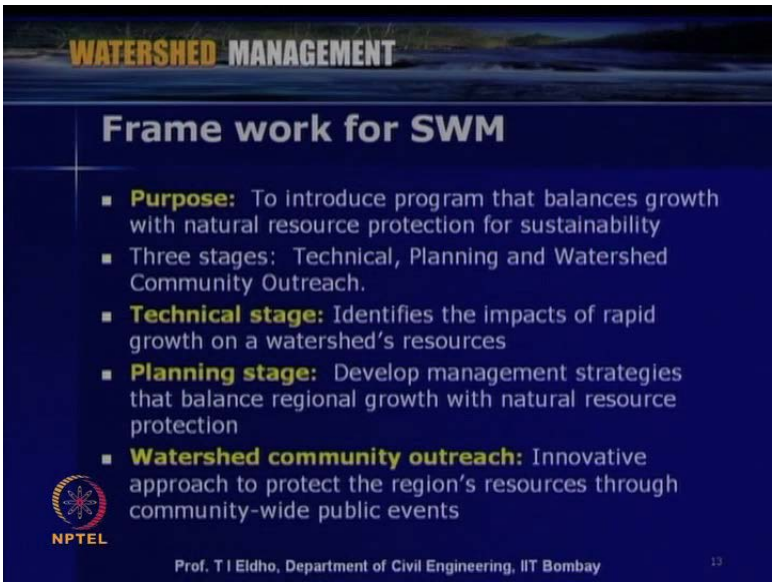

So, as we discussed earlier, the important purpose of sustainable watershed management is to introduce the program, that balance, that balance the growth with natural resource

protection for the sustainability. So, that is the main purpose as far as SWM or sustainable watershed management frame work is concerned.

So, in all this, there are 3 stages, 1st is technical stage, 2nd one is a planning stage and then, watershed community outreach. So, technical stage means, we identify the impacts of rapid growth on watershed's resources, various resources, as far as watershed is concerned. And then, 2nd one is the planning stage. So, here, we have developed the management strategies, that balance regional growth with a natural resource protection within the area, and 3rd one is the watershed community outreach.

So, here, innovative approach to protect the region's resources through community-wide public events, we can when look into. So, within the sustainable watershed management framework, so we have to see the various aspects, like technical aspects, then planning aspects, then how the stake holders involved and then the public or people participation is concerned.

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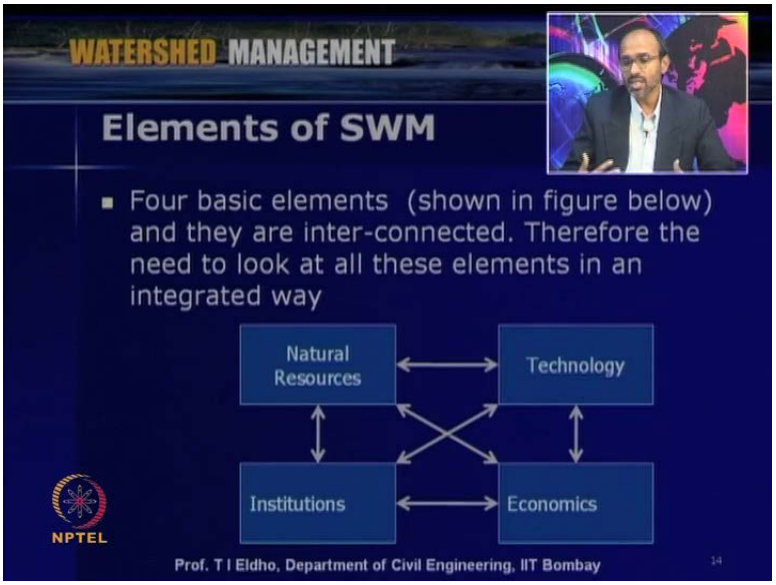

So, now, within this perspective let us look into the, what are the various elements of sustainable watershed management? So, there are 4 important elements as far as sustainable watershed management is concerned. 1st one is natural resources, then what kind of technology we use to, say, develop this natural resource and manage these natural resources and then maintain these natural resources. Then, various institutions

will be come into picture to develop, manage, implement and maintain these natural resources. Then, of course, with this the developmental activities of this natural resources, where the, how the economical situation changes, how the total socio-economic improvement taking place.

So, that way 4 basic elements are shown in this figure. So, these elements are interconnected. So, therefore, we have to look at all these elements in an integrated way. So, that way, many times we will call the sustainable watershed management as an integrated sustainable watershed management. So, when we integrate all these elements together, so we can call the sustainable watershed management as integrated sustainable watershed management.

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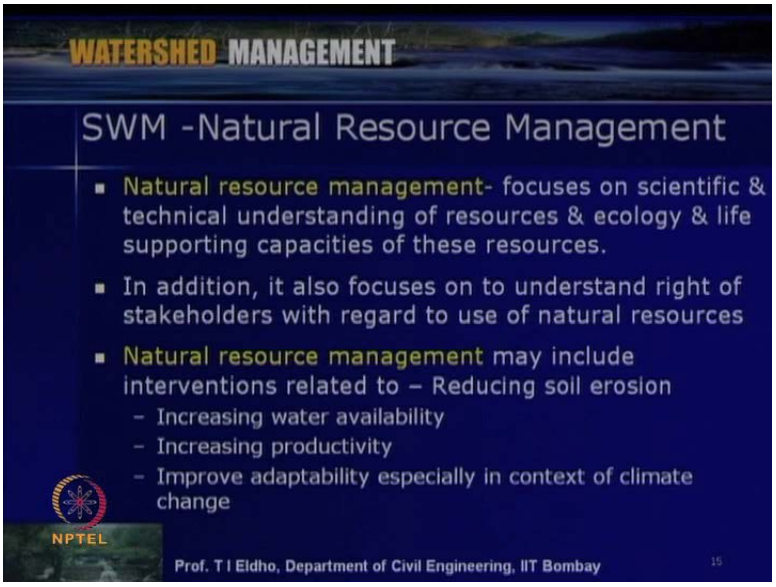

So, now, let us look into the various elements, these 4 elements, which we have seen in the last slide. So, 1st one is the natural resource management. So, this describes the various resources available within the watershed. So, the natural resource management focuses on scientific and technical understanding of the resources, ecology and life supporting capacities of these resources. So, these resources can be either, land, water or forest or any other resources, like mineral resources within that watershed.

So, we, the focus here is, how we can scientifically and technologically develop this resources and manage it in an appropriate way, so that sustainability issues are looked

properly. Then, in addition, this also focus on to understand right of stake holders with regard to the use of natural resources.

So, as we discussed in the last lecture, when we discussed about the stakeholder analysis, there we, we, we have seen, that stakeholders' participation is very important. We have to see their problems and then we have to make plans accordingly. So, as far as the watershed is concerned, the land, the water or the other resources available within the watershed, we have to see, that how the stakeholders needs or how we can cope up with the demands as far as the, the, the various natural resources available within the watershed.

So, then, a natural resource management may include like interventions related to some of the issues, like land related issues, like reducing soil erosion, then water related issues, like increasing water availability, then improving the quality of water, then increasing the productivity as far as biomass is concerned, then improve adaptability, especially in the context of climate changes.

So, you can see that nowadays a major issue is climate change. So, how the changes taking place with respect to the rainfall pattern, with respect to the temperature, with respect to the various hydrological, say parameters are concerned. So, there also we have to see, that how we can adopt the various issues are concerned, then how we can deal with those, those things within the perspective of natural resource management.

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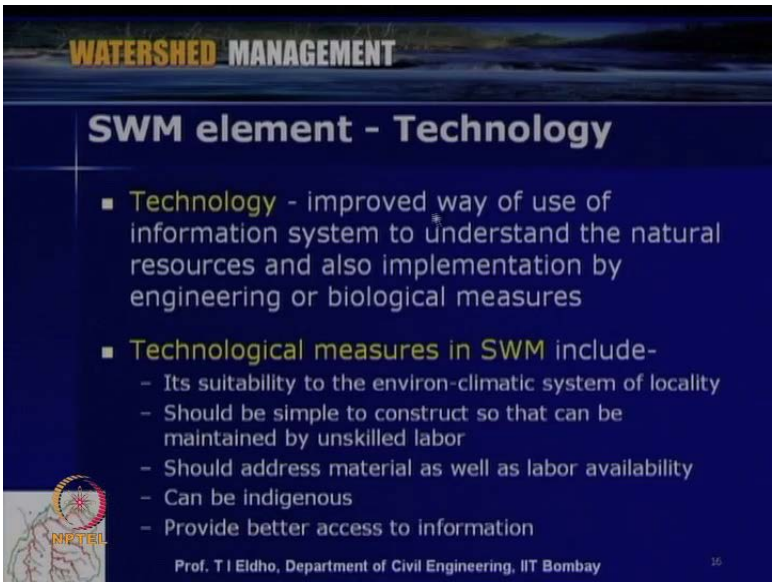

So, then, 2nd important element is technology; so, technology means, how we can utilize the modern technology to improve the available resources or to develop the available resources in an optimal way, in a sustainable way. So, the technology is used to improve the various resources available for the betterment.

So, the improved technologies, the improved way of use of information system, to understand the natural resources, and also implementation by engineering or biological measures. So, this is the technological issues are concerned as far as sustainable watershed management element. Then, technological measures in a SWM include its suitability to the environmental or climatic system, the locality, which we consider.

Then, how we can make various things simple to construct, so that the, whatever we make, it can be maintained by unskilled labour, so without very labour, how we can do the things? Then, the technological measures should address the material as well as labour availability. So, whether we can utilize the locally available material or locally available labour, then whether the technological measures can be indigenous, then whether we can provide better access to information as far as the people or the stakeholders are concerned. So, these are some of the issues as far as technology is concerned.

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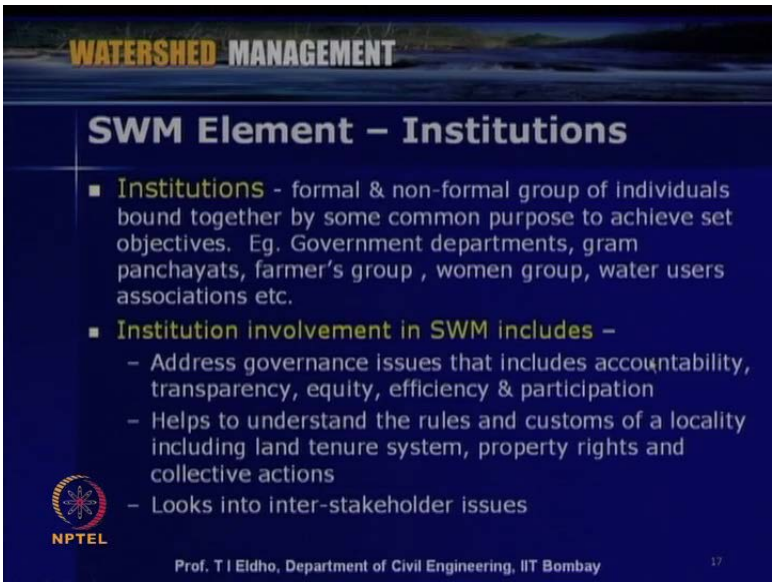

And then, 3rd element is the institutions, as far as SWM is concerned. So, institutions can be formal and non-formal group of individuals bounds together by some common purpose to achieve set of objectives. So, as far as watershed management plans are concerned, we have some set of objectives. So, the institutions can be like the various government departments, then gram panchayat, then the farmer's group, women group or the water users associations, etcetera. So, these are some of the, it can be, say formal institutions or non-formal institutions, like user groups.

So, the institutions involvement in sustainable watershed management includes, like these institutions can address the governance issues, that include accountability, transparency, equity, efficiency and then, people participations' issues are concerned. Then, institutions help to understand the rules and customs of a locality including land tenure system, property rights and collective actions.

Then, also the institutions can look into inter-stakeholder issues. So, we have seen that from the various stakeholders, how effectively the stakeholders can come together or the various stakeholders issues can be sorted out. So, the institutions can be either formal or non-formal groups.

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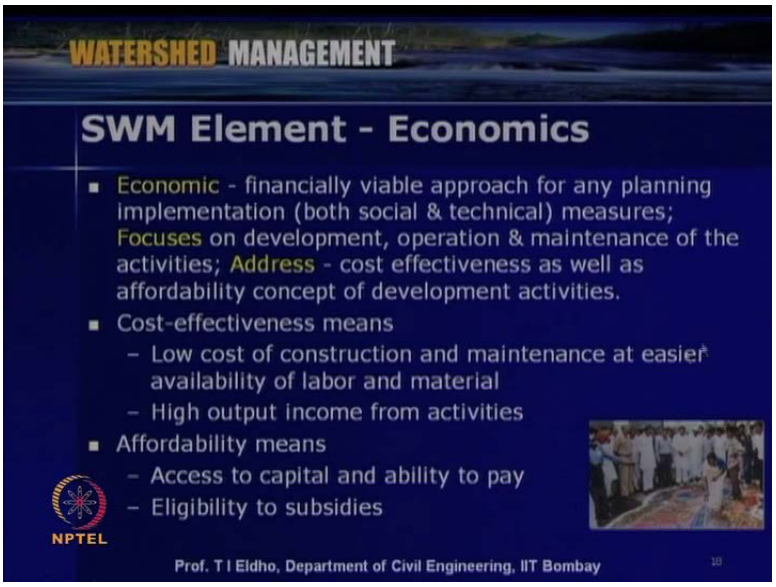

So, then the 4th element is economics. So, the, any of these developmental activities, the sustainable watershed management is concerned, the projects or the plan should be financially viable, so that the implementation measures are concerned, we say, whatever we spent we should be able to get it back here in the course of time. And then, economic issues focus on development operation and maintenance of various activities and this issues also address the cost-effectiveness as well as affordability concept of various development activities or watershed management plans are concerned.

So, as far as cost effectiveness, here cost effectiveness means low cost of construction and maintenance at easier availability of labour and material, so whether we can use locally available material for construction or locally available labour can be utilized, so that the local people also get employment.

Then, high output income from activities. So, we have to see, that whatever we spend, so from that, whether we can get the best output, so that the project is economically viable. Then, affordability means access to capital and ability to pay. So, whether if you are looking for a particular watershed management plan, then if the, if the particular expense, whether we can meet or whether we can borrow the capital or the once it is borrowed, whether the, the particular agencies, particular groups can pay it back, then whether the particular plans are concerned, whether any subsidies are possible? So, all those issues we have to consider when we look into the economics of the sustainable

watershed management are concerned. So, now, we have seen the, 4 elements of sustainable watershed management.

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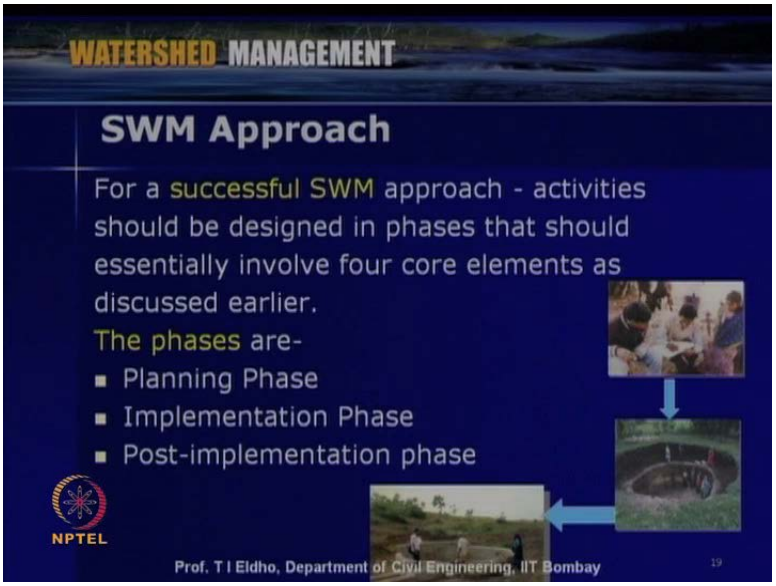

So, now, for a successful sustainable watershed management we have to see, how we can proceed as far as by coordinating, by integrating all these SWM elements are concerned.

So, here, as far as SWM approach is concerned, the SWM approach, that shows the activities, that should be designed in phases that would essentially involve 4 core elements, as we have discussed earlier. So, that way we have to look into the SWM approach. So, this, the phases are planning phase. So, we have to, once we make the watershed management plans, so we should, how better plans, viable plans, economically viable plans. So, through people participation and stakeholder analysis, we can make the plan. So, that 1st one is the planning phase. Then, once the plans are finalized and particular according to the priorities, we can choose the plans.

And then, implementation phase. So, their, say the institutions comes into picture, economics comes into picture, then the people participation people come into picture. So, people can contribute either through economic means or through their, say, efforts. So, like that, a 2nd phase is implementation phase.

And then, once it is implemented, the plans are implemented, then next phase is post-implementation phase, where we have to see, that the plans are working properly. Whether the, whatever we are expecting from that plan, whether we are getting that, say for example, if you are constructing a well, whether we are getting sufficient water from the well and then, we are maintaining the well properly, so that we can use this well for many years. So, that way we have to see the post-implementation phase also.

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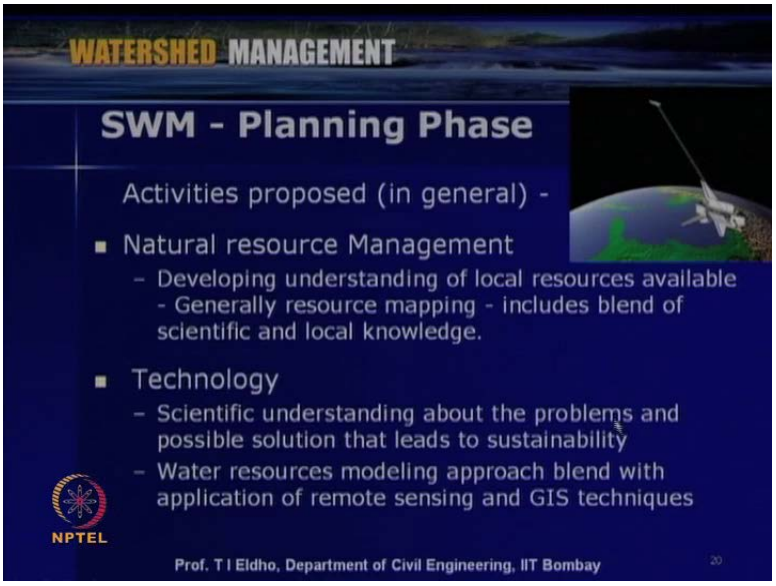

So, as far as the planning phase, when we consider sustainable watershed management is concerned, the activities proposed in general, in group, the natural resource management. So, we have to see, that when the, for the considered watershed, what are the natural resource available, then what way it is already utilized and then, which way we have to further develop it. So, we have to look into the developing, understanding of local resources available.

Generally, resources, we can do a resource planning or resource mapping, which includes blend of scientific and local knowledge. So, this, we can do a survey and then, we can use even the various techniques, sophisticated techniques for resource mapping like a, the use of GIS.

We can do this natural resource mapping, then a technology is concerned, the scientific understanding about the problems and possible solution, that leads to the sustainability,

is concerned. So, we can see that, say, as far as the plans are concerned, watershed management plans are concerned, we can look into, whether the plans are optimal, we can do, go for some optimization techniques. So, so that, say for example, use of water or the release policy from a reservoir, we can optimize and then, we can get, get the optimal output from the development plans.

Then, a water resource modeling approach is concerned, we can blend with application of remote sensing and GIS techniques, as we already discussed earlier. So, remote sensing can be used for the mapping or the land use, land cover imaging, etcetera and then, when we put into a GIS platform, we can further use the, you can have better development plans as far as the planning phase is concerned.

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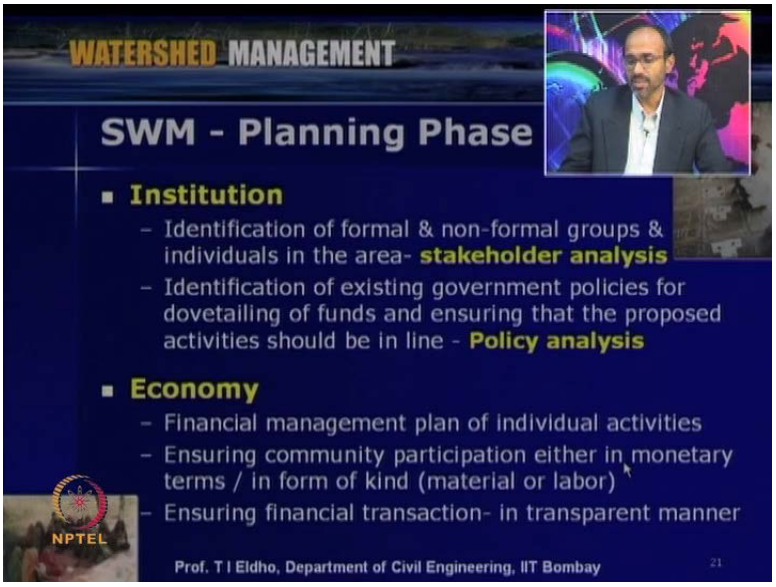

Then, as far as the planning phase is concerned, the roles of institution, so institution, we, as we have already seen, it can be formal or non-formal groups. Then, we say, through a stakeholder analysis, we can understand the roles of each institution. Then, also, we can identify the existing government policies for a dovetailing of funds and ensuring, that the proposed activities should be, whether it is in line with the policies of the government or policies, as far as the watershed is concerned, and also, we can do a policy analysis as we discussed in the last lecture.

Then, also, then next one is, as far as planning phase is concerned, economy. So, as we all discussed, the financial management plans of each project we have to see, then we have, see that the community participation is ensuring through either monetary terms or in form of kind like material or labor, then ensuring financial transaction in a transparent manner. So, all those issues to be considered as far as the planning phase is concerned.

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Then, the next one is the implementation phase. Implementation phase is concerned, the, this cover, the development of necessary infrastructure with a community participation.

So, whatever plans made on priority basis we have to implement it. So, there we have to look for the capacity building, then say, capacity building between the stakeholders, important, and so this is an important activity during the phase. The activities under the phase, phase, are like a natural resource management, as we already discussed. So, there we can identify the land tenure status of the areas for which interventions has been proposed under the planning phase. Then, we can carry out dialogue with land owners for effective utilization like that.

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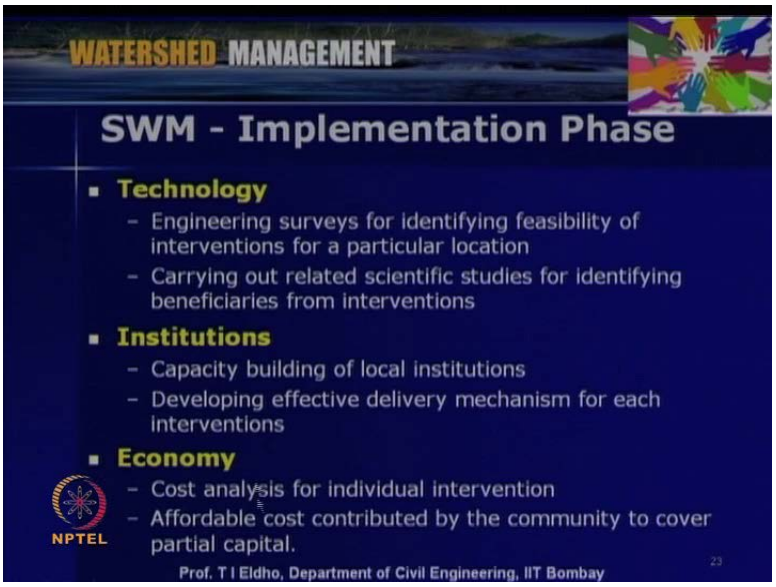

And then also, technology is concerned, we can look into the, say for example, engineering surveys for identifying feasibility of intervention for a particular location is concerned, particular watershed is concerned. Then, we can carry out related scientific studies for identifying beneficiaries from the interventions, then institutions are concerned. Then, in implementation phase, we can see the capacity building of local institutions, how we can improve it, so that they can contribute in a better way.

Then, developing effective delivery mechanism for each intervention, so project-wise how each institution can, say, contributes for that particular project in an effective way. Then, as far as economy is concerned in the implementation phase, we have, we can cost analysis for individual intervention, individual project. Then, affordable cost contributes by the community to cover partial capital. So, if the, say, we are spending say, 1 million rupees, then how much can be, community can contribute or how much we can recover through various subsidies. So, like that various economical issues also we have to consider in the implementation phase.

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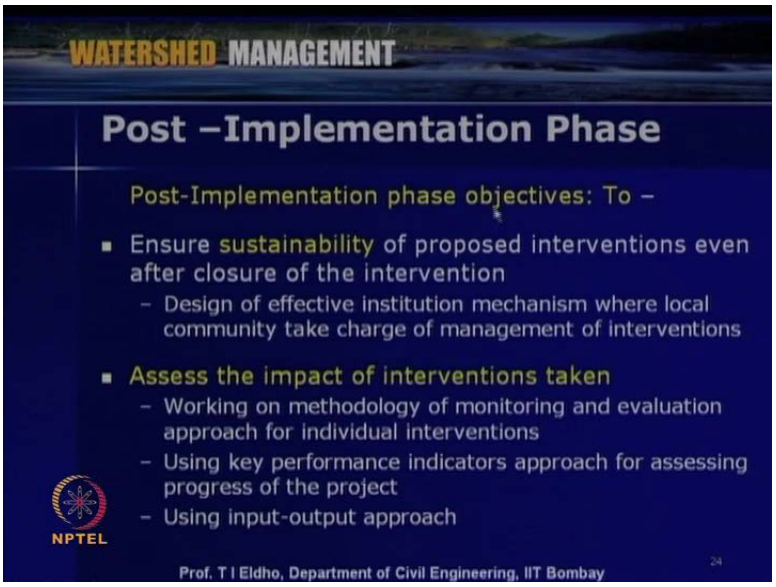

Then, next one is the post-implementation phase. So, here, as I mentioned, so the plans we have already made, then the implementation is done. Next one is, say, the post-implementation. So, how we can maintain and then how we can evaluate, whether the system is working fine? And then, we are getting expected output from the implemented project.

So, the post-implementation phase, the main objectives are to ensure sustainability of proposed intervention even after closure of the intervention. So, once the intervention is planned, implemented, then next one is, we have to see, that whether, that particular intervention is sustainable. So, we can look into the design of effective institution mechanism where local community takes charge of the management of interventions.

So, when we look into the, when we critically analyze the various projects implemented in the watershed management plans, we can see, that the main issue is the, implement the post-implementation phase. So, like the maintenance or the sustainability of the, the, projects, which we have implemented, so there, say we have to see, that we have to ensure, that once the implementation agency, before finishing the project, we have to see, that particular interventions are done, so that local people or local community or particular institutions take care, that particular project. Also, the post-implementation phase, it assess the impact of interventions taken.

So, like a working on methodology of monitoring and evaluation approach for individual interventions, then using key performance indicators approach for assessing the progress of the project. Then, with respect to input output, so how much, say for example, money is spent. Then, how much is the money we can get through, you know, after the implementation in the post-implementation phase. So, like that various aspects we have to consider as far as the post-implementation phase is concerned.

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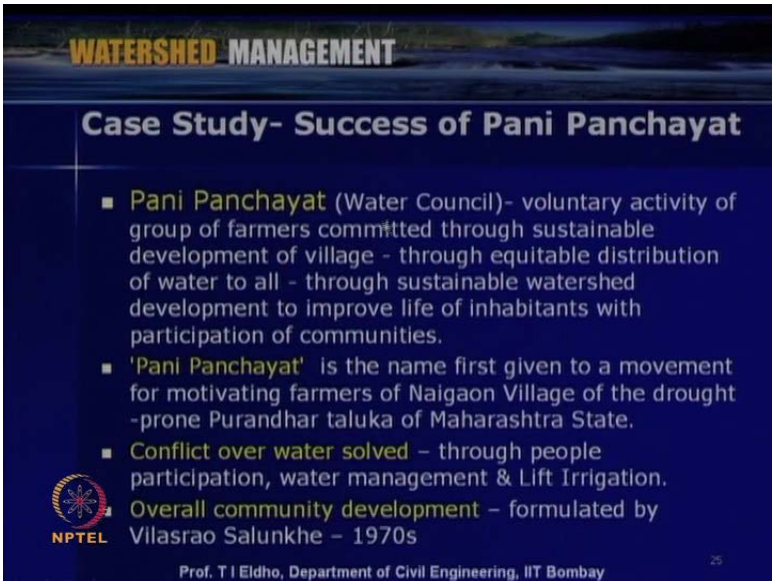

So, so far what we have discussed is the, as far as sustainable watershed management plans are concerned, so we have to first look into the planning phase, then we have to look into the implementation phase, then we have to look into the post-implementation phase, so that the sustainability issues are looked into and the project become sustainable and the project become a success.

So, within this perspective of sustainable watershed management, let us look into a case study. So, the case study presented here is the success of Pani Panchayat, a case study from Maharashtra Pani Panchayat, in english its meaning is water counsel. So, this is a voluntary activity of a group of farmers committed through sustainable development of village through equitable distribution of water to all, through sustainable watershed development to improve life of inhabitants with a participation of communities. So, this is the main, say, theme of Pani Panchayat.

So, Pani Panchayat is the name first given to a movement for motivating formers of Naigaon village of the draught prone Purandhar taluk of Maharashtra state. So, here, the rain, this is a draught prone area, the average annual rainfall is about 500 millimeters. So, once the rainfall is over, no water is available for, say irrigation or even domestic or (( )) purpose.

So, that way, there was a major water scarcity issues and then the villagers, when the rainfall season is over, the villagers use to migrate to other places in looking for a job. So, then, so here, social reformer, known and called, Vilasrao Salunkhe, say he came to this particular area in 1970s and started this project called Pani Panchayat.

So, here, through various interventions he tried to sort out the conflict over water and then, he tried to implement various watershed management practices, like water harvesting, then lift irrigation and then, people participation in various development of the area. So, that way, this Pani Panchayat moment has been started in this region and then, this is has been started in 1970s and it has become a huge success, that is what the analysis showed in, say, project was started in 1970s.

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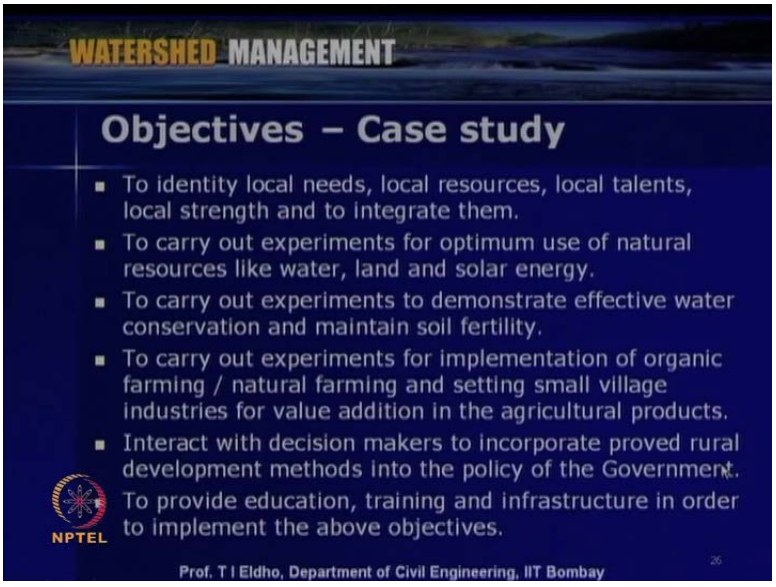

So, here, the main objectives of Pani Panchayat, this project was to identify local needs, say that means, village level, then local resources, local talents, local strength and to

integrate them. So, whatever is available within that village or within that particular watershed, so all those things, say, they organize we are trying to integrate.

Then, to carry out experiments for optimum use of natural resource like water, land and solar energy, then to carry out experiments to demonstrate effective water conservation and they maintain soil fertility, then to carry out experiments for implementation of organic farming, natural farming and setting small village industries form value addition in the agriculture products. Then, to interact with decision makers to incorporate, proved rural development methods into policy of the government, then to provide education, training and infrastructure, in order to implement the above objectives. So, these are, these were the objectives of this Pani Panchayat moment.

So, actually you can see that by looking to these objectives, it is a holistic development by considering the particular watershed, the various resources like land, water, then people, flora and fauna. So, that was the theme of this Pani Panchayat.

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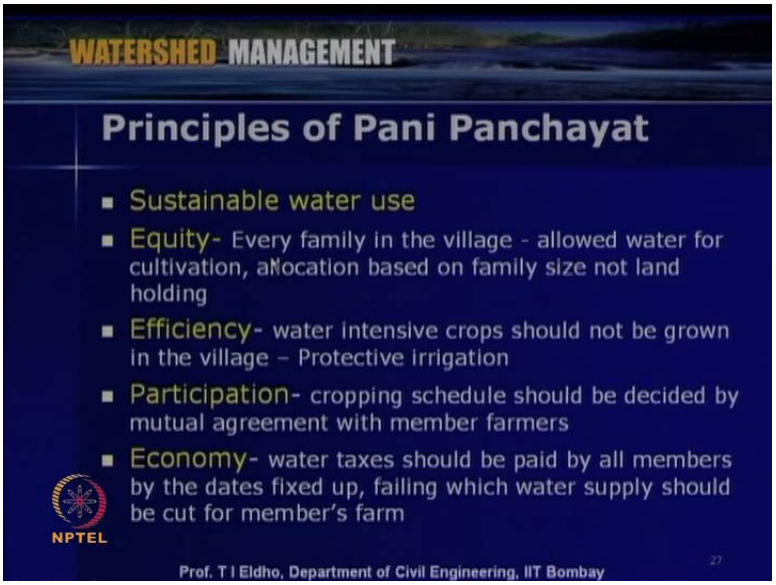

So, there are some 5 important principles of Pani Panchayat. So, 1st one is the sustainable water use within the perspective of land and water use is concerned. Then, the available water, say, water, through either rain water harvesting or through lift irrigation, so equity should be maintained. So, that is another important aspect of this Pani Panchayat. So, every family in the village should get the water in equity distributed

way. So, the family, the families are allowed water for cultivation, allocation is based on land holding, but how many members are there for particular family.

Then, efficiency, so people, the villagers cannot go for any kind of farming, but the water efficient agricultural will be implemented. So, water intensive crop should not be grown in the village, so that, like, say as for example, sugarcane. So, these type of, say, agriculture is not promoted in this area. So, protective irrigation is one important aspect.

Then, participation, so all the formers in the area should participate in various activities. So, cropping schedule should be desired by mutual agreement with member, farmers. Then, another important principle is the economy. So, say, whatever water supply taxes were collected and then, so that the system is sustainable and properly maintained. So, water taxes should be paid by all members by the dates fixed up, failing which water supply should be cut for that member from.

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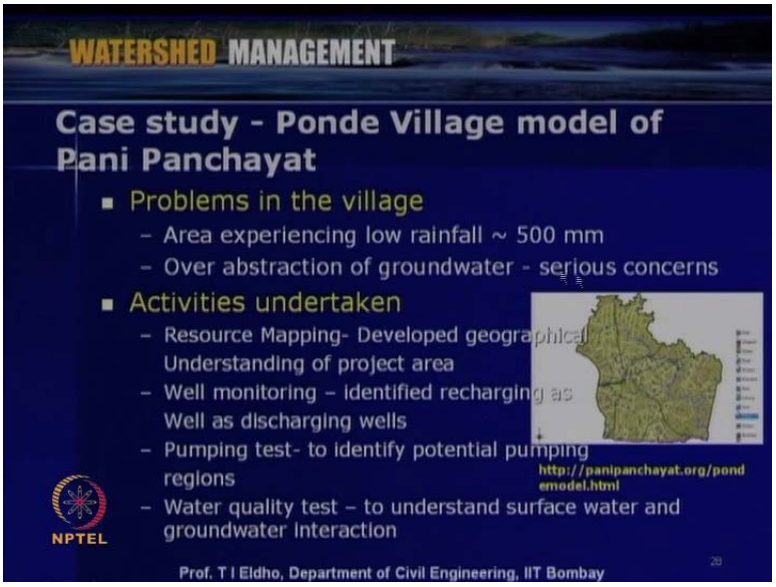

So, so for example, when, say we analyze say one particular village called Ponde village model as far as Pani Panchayat is concerned. So, this particular village in this region, the problems in the village like, the area was experiencing low rainfall before this scheme was implemented, average rainfall was about 500 mm. Over extraction of ground water, then the land was degraded, then there was no sufficient water available for irrigation and even for people, the domestic use water was not available.

So, within this Pani Panchayat, the activities undertaken were resource mapping, like developed. They developed a geographical understanding of project area, then well monitoring, like identifying the recharging and as well as discharging wells and pumping test to identify potential pumping regions, then water quality test to understand surface water and ground water interaction and quality. So, these were some of the activities undertaken for this particular village.

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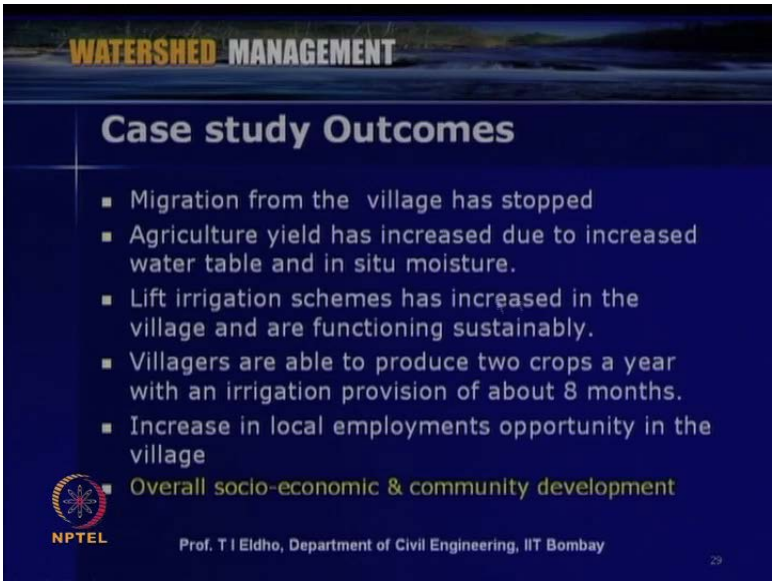

So, somehow the outcomes from, after implementing this Pani Panchayat project was, migration from the village has been stopped after a few years, about 5 years of the implementation of this project. Then, agriculture yield has increased due to increased water table and in situ moisture.

Then, lift irrigation schemes has increased in the village and are functioning sustainably. Then, villages are able to produce 2 crops a year with an irrigation provision of about 8 months; increase in local employment, do opportunity in the village. So, finally, once situ, the area is analyzed, overall socio-economic and community development has been taken place after implementing this Pani Panchayat, say, say, for this particular area.

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So, these are some of the important references used for today's lecture. So, these Pani Panchayat aspects you can see in this website.

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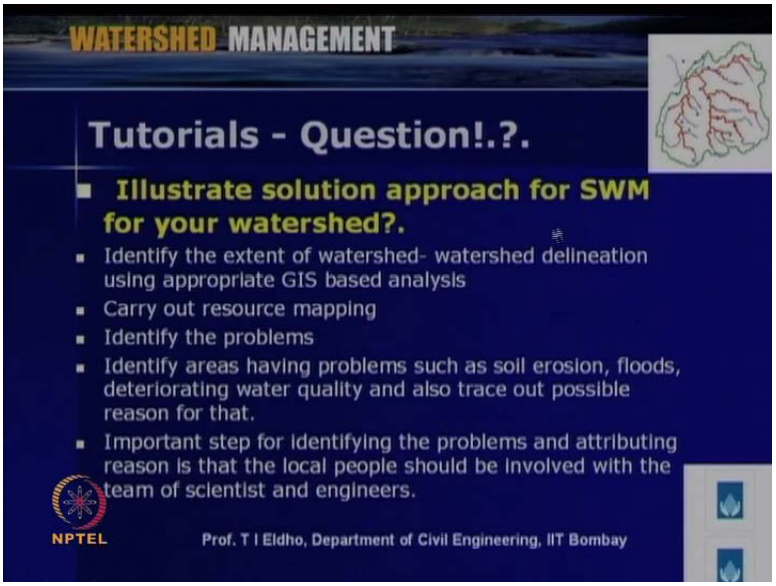

So, before closing this lecture, so 1 tutorial question like an illustrate solution approach for sustainable watershed management, for your particular watershed, which you are leaving. So, some of the steps are identified here, like identify the extent of watershed, watershed delineation using appropriate GIS based analysis. Then, carry out resource mapping; identify the problems; identify areas having problems, such as soil erosion, floods, etcetera.

Then, important steps for identifying the problems and attributing reason for that particular problems. So, you can do a sustainable watershed management approach for your particular watershed. So, these are tutorial question.

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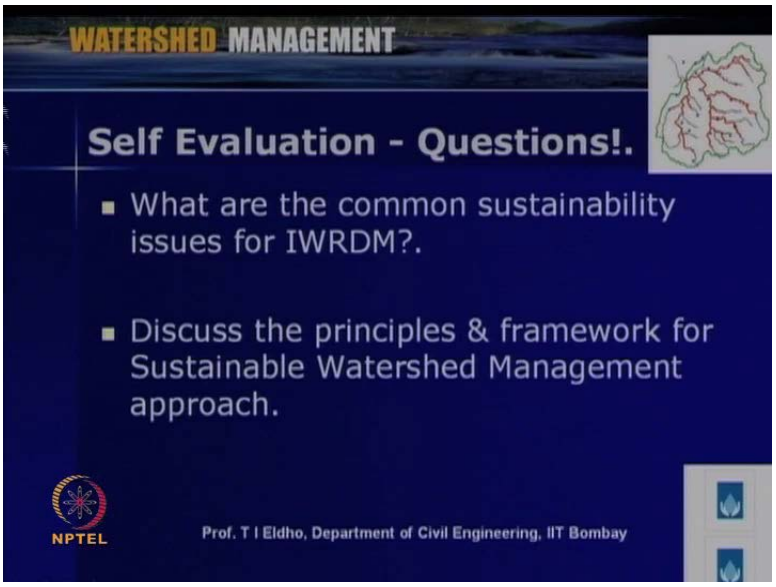

Then, self evaluation questions, 2 questions are put here. What are the common sustainability issues for integrated water resource development management? So, these issues we have already discussed in the lecture. And discuss the principle and framework for sustainable watershed management approach. So, these are also we have discussed in the lecture.

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3 questions are put as assignment, 1st one is explain the elements of sustainable watershed management; 2nd one is illustrate sustainable watershed management approach; 3rd one is, discuss a case study of sustainable watershed management.

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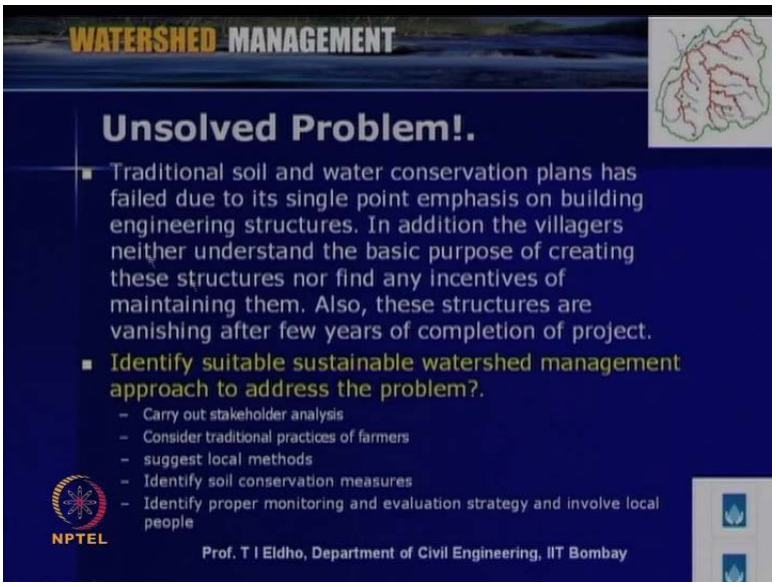

So, finally, one unsolved problem. So, the problem is like this, traditional soil and water conservation plans has failed due to its single point emphasis on building engineering structures. In addition, the villagers neither understand the basic purpose of creating these structures, nor find any incentives for maintaining them. Also, these structures are vanishing after few years' completion of project. So, within this perspective, you can identify suitable sustainable watershed management approach to address the problem mentioned here.

So, some of the hints are given. So, like, you can carry out a stakeholder analysis. Consider traditional practices used by farmers, suggest local method, identify soil conservation measures, identifying proper monitoring evaluation, etcetera. So, this, for your particular area, you can look into some of the implemented projects in earlier stages, like some of the structures construct like a check dam and then analyze, as mentioned here.

So, with this, the 4th lecture in this watershed management and 1st lecture in the 2nd module is over. So, the various, we have discussed the, mainly the sustainable watershed management and a various issues.

Thank You.